ADOPTION ABANDONMENT FEEDING

Over Population of *Stray Dogs*

A Systemic study on India's stray dogs

Vaccination Rabies Cases Animal Cruelty Sterilization

Indie dogs

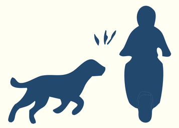
India's free-roaming **native dogs** are an indigenous village-dog **land-race**, naturally shaped by the India's **environment, human settlements** and generations of **coexistence**, rather than controlled breeding.

These Indie dogs are **domesticated** and **locally adapted** to their environment and are best suited for the **variety of conditions** India consists of.

From Meat to Dal Roti

Domestic dogs evolved from **wolves** and gradually adapted to live alongside humans. In India, indigenous dogs evolved into the **Indian Pariah or Indie dog**, adapting to local environments and human settlements. Their **diet also shifted from hunting** towards **human-associated food**, including rice, roti, dal, food scraps, and meat, making them deeply **adapted to life alongside humans.**

Urbanization

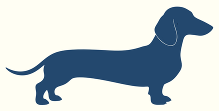


As India **urbanized**, human infrastructure supported free-ranging dogs, while increasingly **gated spaces** reduced **human contact and tolerance**. Dogs once familiar to open neighborhoods were increasingly seen as **unwanted**, creating greater pressure for **population control and removal.**

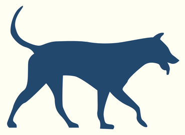
Stray

[streɪ] Noun/adjective

An **animal** that has wandered **away from human ownership, control**, or its expected place of residence and lives or moves freely without a clearly identifiable owner.



Cute



Not cute :/

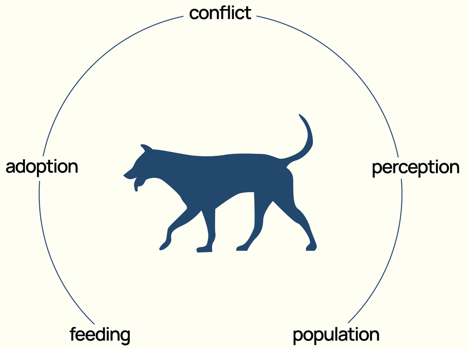
Pariah - *"Ye toh paraya hai, hamara nahi"*

Colonialism significantly influenced how these dogs were perceived. British authorities also introduced and reinforced systems of controlling urban free-ranging dogs, including **large-scale killing** campaigns associated with concerns around **rabies and public health**.

During the colonial period, Europeans used the term **"pariah"** for indigenous free-ranging dogs—a term connected to the Paraiyar community of South India and carrying the meaning of an **outcast** in English usage. The label reflected a hierarchy in which local free-ranging dogs were often viewed as **undesirable**, while European **pedigree breeds** were imported and valued for hunting, companionship, and **status.**

Scope

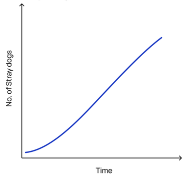
This project investigates the **Indian free-roaming dog** ecosystem as a connected system, examining how **population, welfare,** public **perception,** human **conflict, government intervention** and **community behaviour** influence one another.



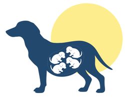
conflict
adoption
perception
feeding
population

Behaviour- *Time Graphs*

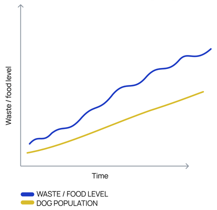
Stray Dog Population



"When births exceed, stray dog numbers rise."

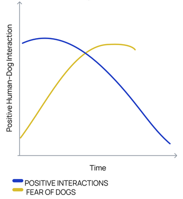


Food & Waste level Vs Dog Population



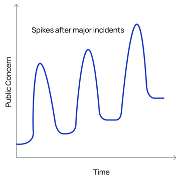
"More food and waste supports more stray dogs."

Human - Dog Interaction



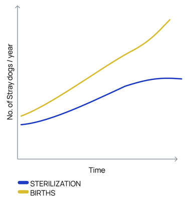
"More fear leads to fewer positive human - dog interactions."

Public concern



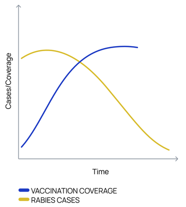
"Major incidents cause sudden spikes in public concern."

Sterilisation vs Births

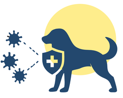


"Births outpace sterilisation, increasing stray dog numbers."

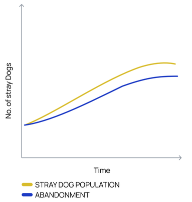
Rabies Cases Vs Vaccination



"Higher vaccination coverage gradually reduces rabies cases."



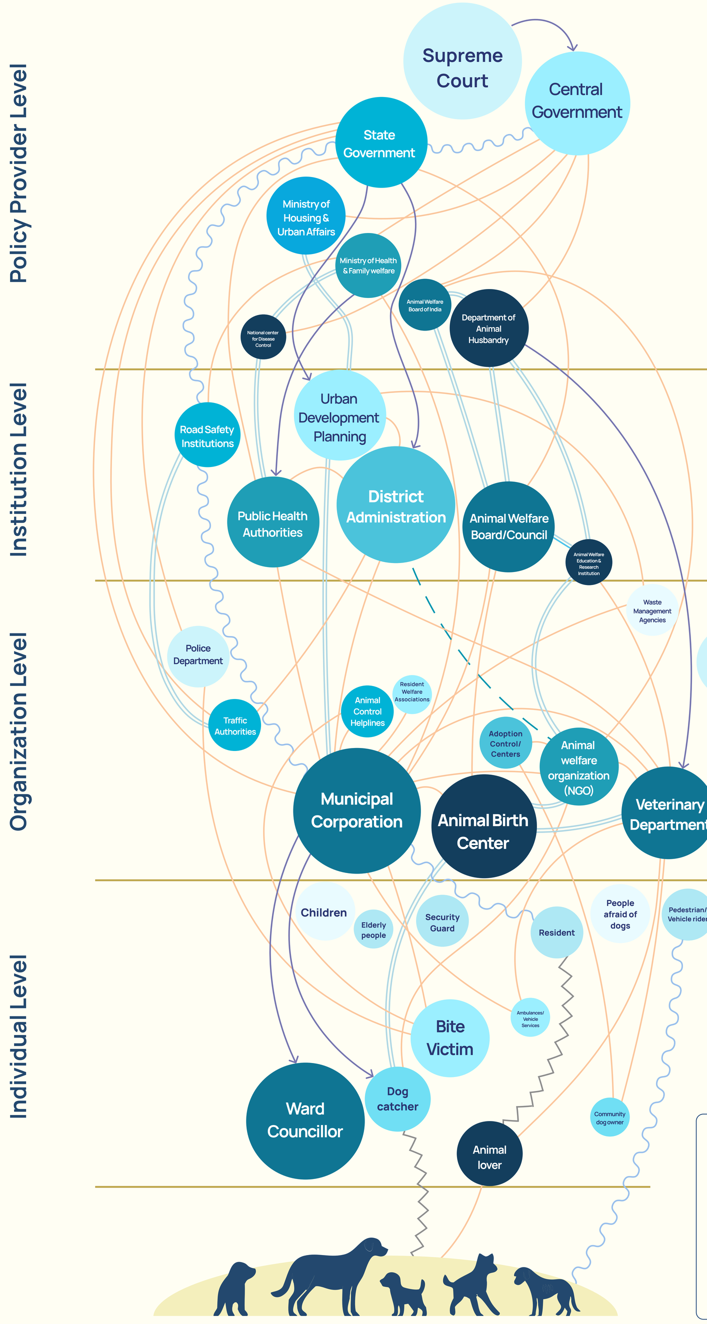
Abandonment



"Abandonment adds more dogs to streets and shelters."

Actors' *Map*

This map places the key actors within the stray-do
dependencies between them. It highlights the nat
influences or is influenced by others. Together, th
which actions and decisions shape the stray-dog



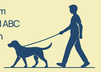
Policy Provider Level
Institution Level
Organization Level
Individual Level
Supreme Court
Central Government
State Government
Ministry of Housing & Urban Affairs
Ministry of Health & Family welfare
Animal Welfare Board of India
Department of Animal Husbandry
National center for Disease Control
Road Safety Institutions
Urban Development Planning
Public Health Authorities
District Administration
Animal Welfare Board/Council
Animal Welfare Education & Research Institution
Waste Management Agencies
Police Department
Traffic Authorities
Animal Control Helplines
Resident Welfare Associations
Adoption Control/ Centers
Animal welfare organization (NGO)
Municipal Corporation
Animal Birth Center
Veterinary Department
Children
Elderly people
Security Guard
Resident
People afraid of dogs
Pedestrian/ Vehicle rider
Ambulances/ Vehicle Services
Bite Victim
Ward Councillor
Dog catcher
Animal lover
Community dog owner

Higher authorities have more power but less ground-level insight.

Ground-level actors have strong knowledge but limited decision-making power.

Despite little direct connection to stray-dog management, waste management has a significant influence on the system

Adopters enter the system mainly through NGOs and ABC Centres, making adoption dependent on these intermediary actors.



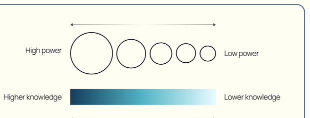
Municipal Corporation connects ground-level knowledge with decision-making.

Pet Owners sit at the intersection of pet ownership and the wider animal ecosystem, but their connection to stray-dog management is limited.

og system and visualizes the relationships and
ture of their interactions, showing how each actor
ese connections reveal the broader network through
system.

Fairly close relationship	—
Alliance	═
Discord/Conflict	∧∧∧
Oscillating relationship	∿∿∿
Informal/Emergent	- - -
Predominant influence	→

News and Media
Social Media


High power
Low power
Higher knowledge
Lower knowledge

KNOWLEDGE - How much relevant understanding an actor possesses about the system/problem you are studying.

POWER - The actor's ability to influence, control, alter, or make decisions within the system.

ABC Centres and NGOs connect multiple stages of the system, from veterinary care and sterilisation to monitoring and adoption.

News & Media sits outside the core operational network, indicating a gap between public narrative and on-ground programme implementation.

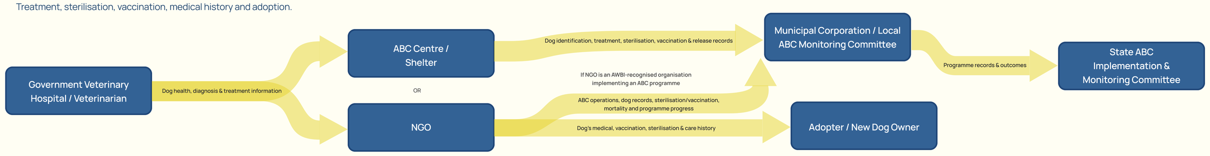
Information *Flows*

Information Actors

Information Passed

I. Dog lifecycle & care information

Treatment, sterilisation, vaccination, medical history and adoption.



Government Veterinary Hospital / Veterinarian

Dog health, diagnosis & treatment information

ABC Centre / Shelter

OR

NGO

Dog identification, treatment, sterilisation, vaccination & release records

If NGO is an AWBI-recognised organisation implementing an ABC programme

ABC operations, dog records, sterilisation/vaccination, mortality and programme progress

Dog's medical, vaccination, sterilisation & care history

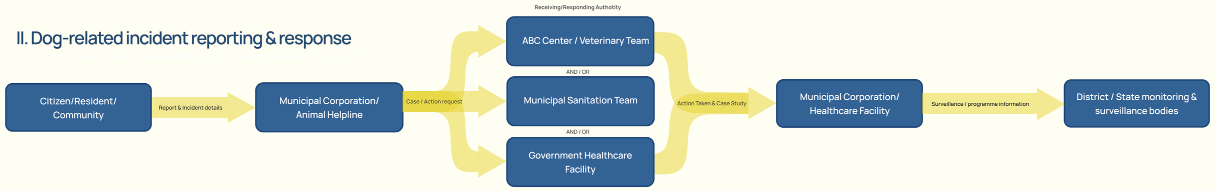
Municipal Corporation / Local ABC Monitoring Committee

Adopter / New Dog Owner

Programme records & outcomes

State ABC Implementation & Monitoring Committee

II. Dog-related incident reporting & response



Citizen/Resident/ Community

Report & Incident details

Municipal Corporation/ Animal Helpline

Case / Action request

Receiving/Responding Authotity

ABC Center / Veterinary Team

AND / OR

Municipal Sanitation Team

AND / OR

Government Healthcare Facility

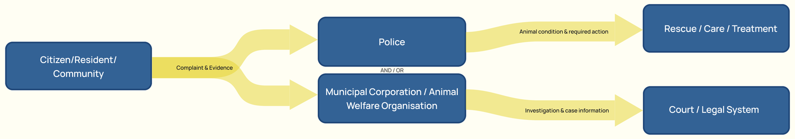
Action Taken & Case Study

Municipal Corporation/ Healthcare Facility

Surveillance / programme information

District / State monitoring & surveillance bodies

III. Animal cruelty response



Citizen/Resident/ Community

Complaint & Evidence

Police

AND / OR

Municipal Corporation / Animal Welfare Organisation

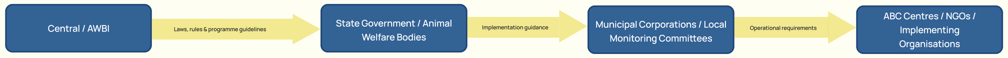
Animal condition & required action

Rescue / Care / Treatment

Investigation & case information

Court / Legal System

IV. Animal welfare laws & implementation



Central / AWBI

Laws, rules & programme guidelines

State Government / Animal Welfare Bodies

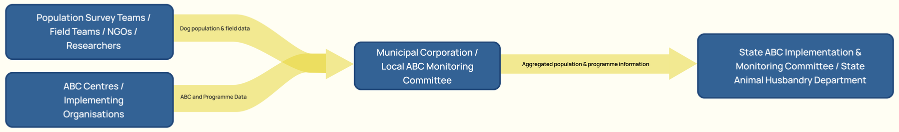
Implementation guidance

Municipal Corporations / Local Monitoring Committees

Operational requirements

ABC Centres / NGOs / Implementing Organisations

V. Dog population & programme monitoring



Population Survey Teams / Field Teams / NGOs / Researchers

Dog population & field data

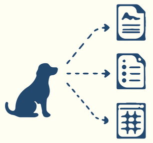
ABC Centres / Implementing Organisations

ABC and Programme Data

Municipal Corporation / Local ABC Monitoring Committee

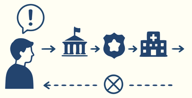
Aggregated population & programme information

State ABC Implementation & Monitoring Committee / State Animal Husbandry Department



Inconsistent Reporting (II)
Reporting processes and formats may vary across localities, leading to inconsistent information.

Fragmented Incident Information (II)
The same incident information may need to pass through multiple organisations, increasing handovers and duplication.

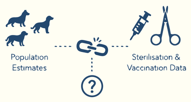


Lack of Feedback to Reporters (II)
People who report an issue may not receive clear updates on whether action was taken or how the case was resolved.

Fragmented Multi-Agency Response (III)
A single incident can involve several organisations, but information and responsibility are divided across separate pathways.

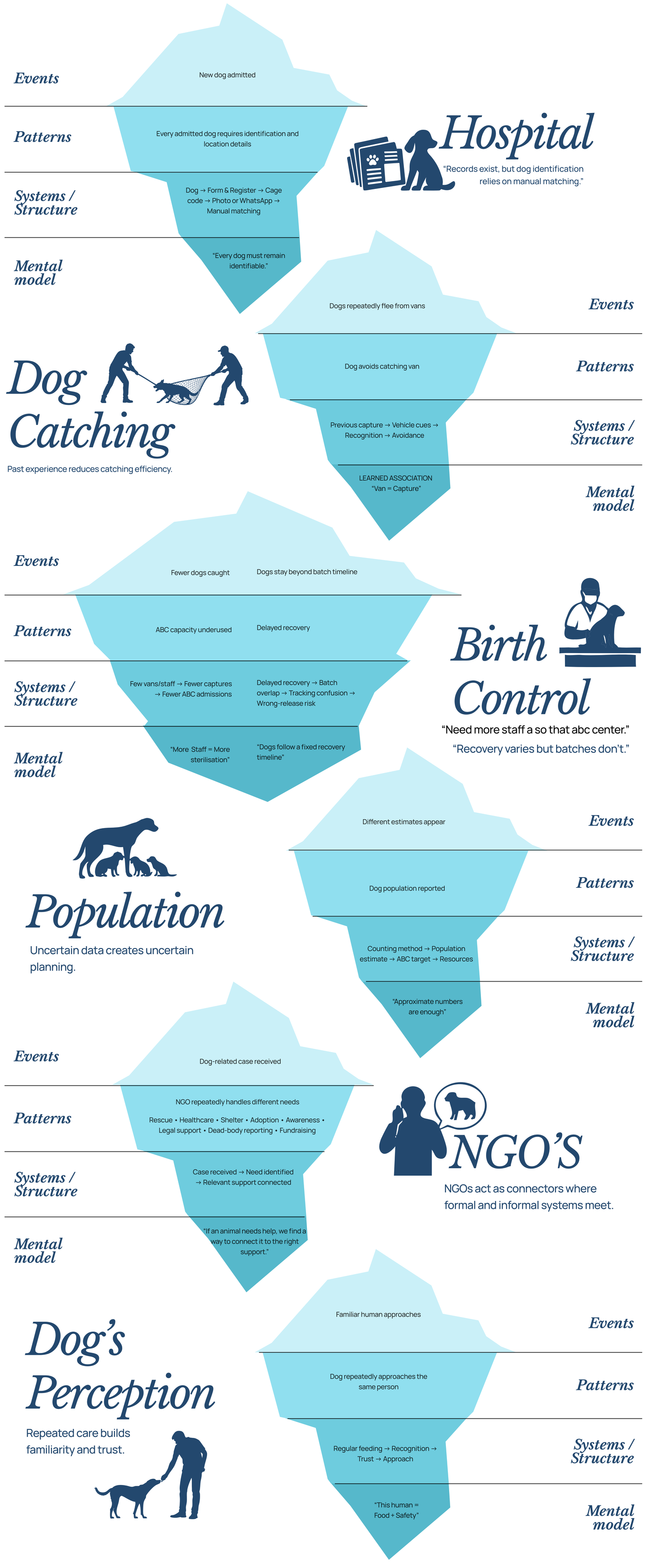
Friction in Pursuing Legal Action (III)
The legal route can require significant time, effort and follow-up from the complainant, potentially discouraging cases from progressing.

Variation in On-Ground Implementation (IV)
Policy and guidelines pass through multiple administrative levels, and differences in local capacity and coordination can lead to variation between prescribed rules and on-ground practice.


Population Estimates
Sterilisation & Vaccination Data

Linking Population and Intervention Data (V)
Population estimates and intervention records are collected separately, making it difficult to track how sterilisation and vaccination efforts influence population change over time.

Ice *Berg*


Events
Patterns
Systems / Structure
Mental model

Hospital

"Records exist, but dog identification relies on manual matching."

Events: New dog admitted

Patterns: Every admitted dog requires identification and location details

Systems / Structure: Dog → Form & Register → Cage code → Photo or WhatsApp → Manual matching

Mental model: "Every dog must remain identifiable."

Dog Catching

Past experience reduces catching efficiency.

Events: Dogs repeatedly flee from vans

Patterns: Dog avoids catching van

Systems / Structure: Previous capture → Vehicle cues → Recognition → Avoidance

Mental model: LEARNED ASSOCIATION "Van = Capture"

Birth Control

"Need more staff a so that abc center."

"Recovery varies but batches don't."

Events: Fewer dogs caught — Dogs stay beyond batch timeline

Patterns: ABC capacity underused — Delayed recovery

Systems / Structure: Few vans/staff → Fewer captures → Fewer ABC admissions — Delayed recovery → Batch overlap → Tracking confusion → Wrong-release risk

Mental model: "More Staff = More sterilisation" — "Dogs follow a fixed recovery timeline"

Population

Uncertain data creates uncertain planning.

Events: Different estimates appear

Patterns: Dog population reported

Systems / Structure: Counting method → Population estimate → ABC target → Resources

Mental model: "Approximate numbers are enough"

NGO'S

NGOs act as connectors where formal and informal systems meet.

Events: Dog-related case received

Patterns: NGO repeatedly handles different needs
Rescue • Healthcare • Shelter • Adoption • Awareness • Legal support • Dead-body reporting • Fundraising

Systems / Structure: Case received → Need identified → Relevant support connected

Mental model: "If an animal needs help, we find a way to connect it to the right support."

Dog's Perception

Repeated care builds familiarity and trust.

Events: Familiar human approaches

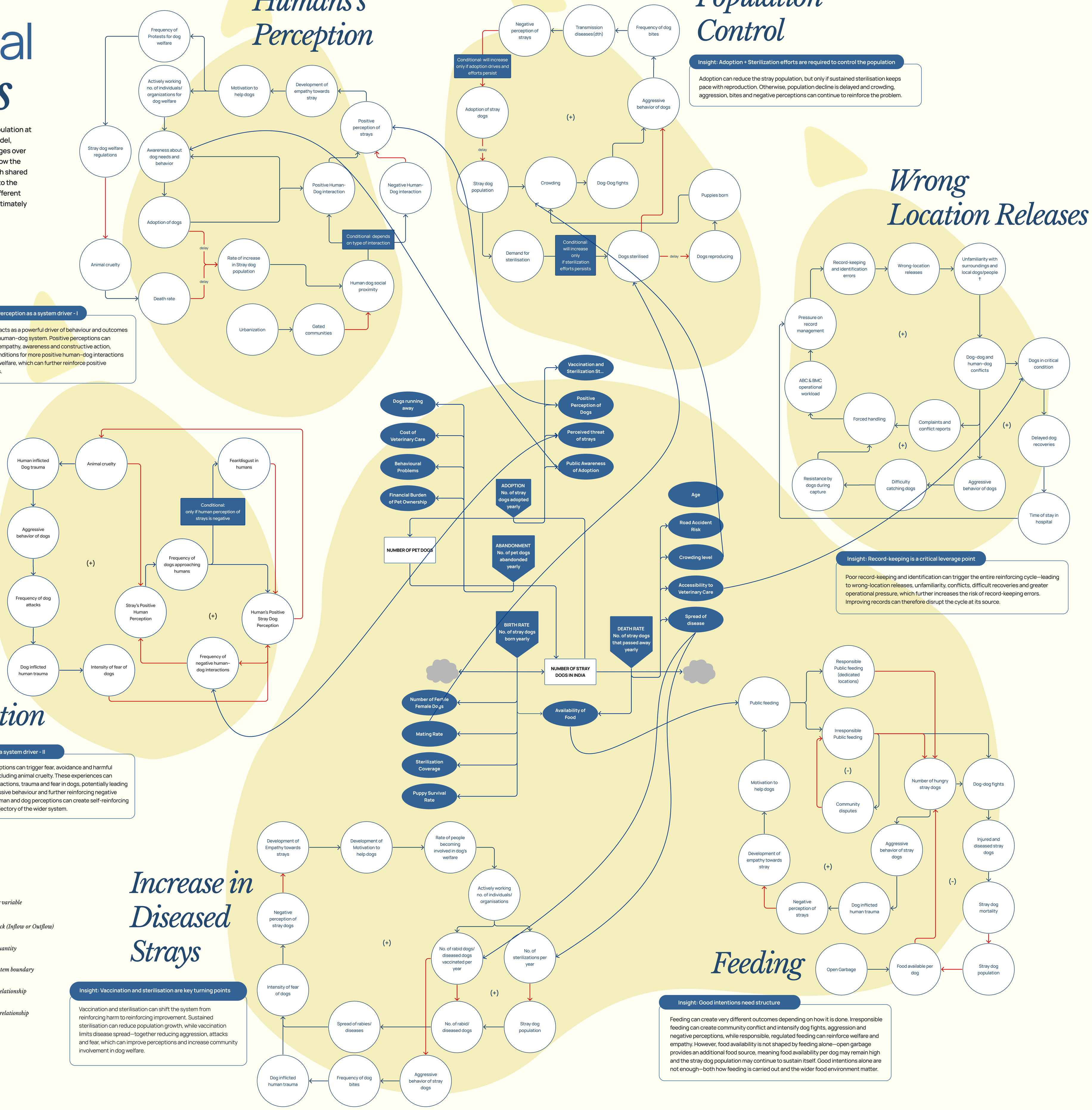
Patterns: Dog repeatedly approaches the same person

Systems / Structure: Regular feeding → Recognition → Trust → Approach

Mental model: "This human = Food + Safety"

Causal *Loops*

This map places the stray-dog population at the center as a stock-and-flow model, showing how the population changes over time. Surrounding causal loops show the different factors influencing it, with shared variables connecting these loops to the central model and showing how different parts of the system interact and ultimately affect the dog population.


Frequency of Protests for dog welfare
Actively working no. of individuals/ organizations for dog welfare
Motivation to help dogs
Development of empathy towards stray
Positive perception of strays
Stray dog welfare regulations
Awareness about dog needs and behavior
Positive Human-Dog interaction
Negative Human-Dog interaction
Adoption of dogs
Conditional: depends on type of interaction
delay
Rate of increase in Stray dog population
delay
Animal cruelty
Death rate
Human dog social proximity
Urbanization
Gated communities
Negative perception of strays
Transmission diseases(dth)
Frequency of dog bites
Conditional: will increase only if adoption drives and efforts persist
Adoption of stray dogs
(+)
Aggressive behavior of dogs
delay
Stray dog population
Crowding
Dog-Dog fights
Puppies born
Demand for sterilisation
Conditional: will increase only if sterilization efforts persists
Dogs sterilised
delay
Dogs reproducing
Record-keeping and identification errors
Wrong-location releases
Unfamiliarity with surroundings and local dogs/people ↑
Pressure on record management
(+)
ABC & BMC operational workload
Dog-dog and human-dog conflicts
Dogs in critical condition
Forced handling
Complaints and conflict reports
(+)
(+)
Delayed dog recoveries
Resistance by dogs during capture
Difficulty catching dogs
Aggressive behavior of dogs
Time of stay in hospital
Vaccination and Sterilization St...
Dogs running away
Positive Perception of Dogs
Cost of Veterinary Care
Perceived threat of strays
Behavioural Problems
Public Awareness of Adoption
Financial Burden of Pet Ownership
ADOPTION No. of stray dogs adopted yearly
Age
NUMBER OF PET DOGS
ABANDONMENT No. of pet dogs abandoned yearly
Road Accident Risk
Crowding level
Accessibility to Veterinary Care
BIRTH RATE No. of stray dogs born yearly
DEATH RATE No. of stray dogs that passed away yearly
Spread of disease
NUMBER OF STRAY DOGS IN INDIA
Number of Fertile Female Dogs
Availability of Food
Mating Rate
Sterilization Coverage
Puppy Survival Rate
Human inflicted Dog trauma
Animal cruelty
Fear/disgust in humans
Conditional: only if human perception of strays is negative
Aggressive behavior of dogs
Frequency of dogs approaching humans
(+)
Frequency of dog attacks
Stray's Positive Human Perception
(+)
Human's Positive Stray Dog Perception
Dog inflicted human trauma
Intensity of fear of dogs
Frequency of negative human-dog interactions
Responsible Public feeding (dedicated locations)
Public feeding
Irresponsible Public feeding
(-)
Motivation to help dogs
Community disputes
Number of hungry stray dogs
Dog-dog fights
Injured and diseased stray dogs
Development of empathy towards stray
(+)
Aggressive behavior of stray dogs
(-)
Negative perception of strays
Dog inflicted human trauma
Stray dog mortality
Open Garbage
Food available per dog
Stray dog population
Development of Empathy towards strays
Development of Motivation to help dogs
Rate of people becoming involved in dog's welfare
Actively working no. of individuals/ organisations
Negative perception of stray dogs
(+)
No. of rabid dogs/ diseased dogs vaccinated per year
No. of sterilizations per year
Intensity of fear of dogs
(+)
Spread of rabies/ diseases
No. of rabid/ diseased dogs
Stray dog population
Dog inflicted human trauma
Frequency of dog bites
Aggressive behavior of stray dogs

Humans's Perception

Insight: Perception as a system driver - I

Perception acts as a powerful driver of behaviour and outcomes across the human-dog system. Positive perceptions can encourage empathy, awareness and constructive action, creating conditions for more positive human-dog interactions and better welfare, which can further reinforce positive perceptions.

Population Control

Insight: Adoption + Sterilization efforts are required to control the population

Adoption can reduce the stray population, but only if sustained sterilisation keeps pace with reproduction. Otherwise, population decline is delayed and crowding, aggression, bites and negative perceptions can continue to reinforce the problem.

Wrong Location Releases

Insight: Record-keeping is a critical leverage point

Poor record-keeping and identification can trigger the entire reinforcing cycle—leading to wrong-location releases, unfamiliarity, conflicts, difficult recoveries and greater operational pressure, which further increases the risk of record-keeping errors. Improving records can therefore disrupt the cycle at its source.

Stray Dog's Perception

Insight: Perception as a system driver - II

Conversely, negative perceptions can trigger fear, avoidance and harmful behaviour towards dogs, including animal cruelty. These experiences can contribute to negative interactions, trauma and fear in dogs, potentially leading to more defensive or aggressive behaviour and further reinforcing negative perceptions. Thus, both human and dog perceptions can create self-reinforcing patterns that shape the trajectory of the wider system.

Increase in Diseased Strays

Insight: Vaccination and sterilisation are key turning points

Vaccination and sterilisation can shift the system from reinforcing harm to reinforcing improvement. Sustained sterilisation can reduce population growth, while vaccination limits disease spread—together reducing aggression, attacks and fear, which can improve perceptions and increase community involvement in dog welfare.

Feeding

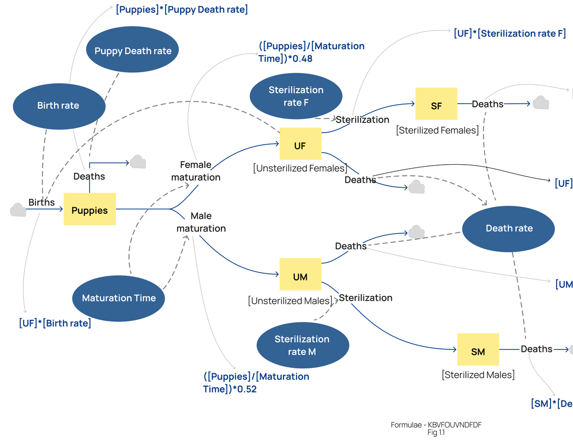
Insight: Good intentions need structure

Feeding can create very different outcomes depending on how it is done. Irresponsible feeding can create community conflict and intensify dog fights, aggression and negative perceptions, while responsible, regulated feeding can reinforce welfare and empathy. However, food availability is not shaped by feeding alone—open garbage provides an additional food source, meaning food availability per dog may remain high and the stray dog population may continue to sustain itself. Good intentions alone are not enough—both how feeding is carried out and the wider food environment matter.

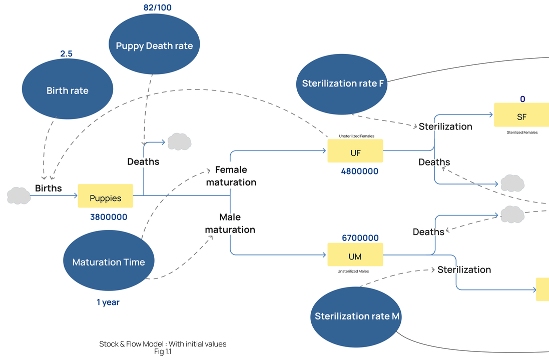
⬬	*Auxiliary / influencing variable*
⬟	*Rate of change of a stock (Inflow or Outflow)*
▭	*Stock / accumulated quantity*
☁	*Element outside the system boundary*
→	*Directly proportional relationship*
→	*Inversely proportional relationship*
(+)	*Reinforcing Loops*
(-)	*Balancing Loops*

Syste
& Sim

A system-dynamics model was developed in Insight Maker to explore how male and female sterilization rates influence the stray dog population over time. The model projects population behaviour over a 20-year period, allowing different sterilization scenarios to be compared.

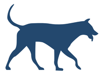

[Puppies]*[Puppy Death rate]
Puppy Death rate
Birth rate
([Puppies]/[Maturation Time])*0.48
Sterilization rate F
[UF]*[Sterilization rate F]
SF
Deaths
Sterilization
[Sterilized Females]
UF
[Unsterilized Females]
Deaths
Female maturation
Births
Puppies
Deaths
[UF]
Male maturation
Death rate
Deaths
UM
[UM
[Unsterilized Males]
Sterilization
Maturation Time
[UF]*[Birth rate]
Sterilization rate M
([Puppies]/[Maturation Time])*0.52
SM
Deaths
[Sterilized Males]
[SM]*[De

Formulae - KBVFOUVNDFDF
Fig 1.1


82/100
Puppy Death rate
2.5
Birth rate
Sterilization rate F
0
SF
Sterilized Females
Sterilization
Unsterilized Females
UF
4800000
Deaths
Births
Puppies
3800000
Female maturation
Male maturation
Deaths
6700000
UM
Unsterilized Males
Sterilization
Maturation Time
1 year
Sterilization rate M

Stock & Flow Model : With initial values
Fig 1.1

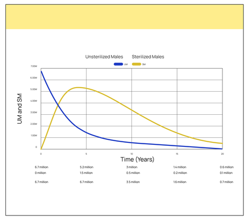
3 scenarios are explored: Government Guidelines, representing the rec
to operational constraints; and Gender Ratio Disparity, for the difficulty



Govt Guidelines

Male Sterilization Rate 70%
Female Sterilization Rate 70%

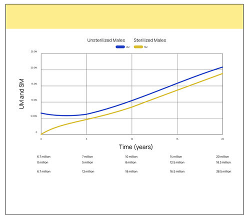
Government guideline which is 70% sterilization, regardless of gender so we will take 70% male and 70% females sterilization



Reality (%)

Male Sterilization Rate 30%
Female Sterilization Rate 30%

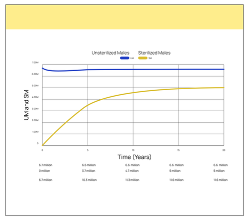
Implementation does not happen as per the policy because of limited number of resources



Reality (ratio)

Male Sterilization Rate 40%
Female Sterilization Rate 20%

Ratio disparity because females are harder to catch, they stay in dens.
Females are also more expensive to sterilize.



n model ulator

[SF]*[Death rate]

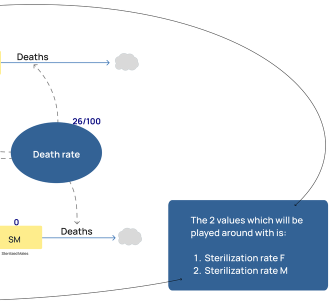
*[Death rate]

]*[Death rate]

ath rate]

The stock-and-flow diagrams show the population structure, flows, delays, and equations that drive the projections. The resulting graphs help reveal how changes in sterilization rates may affect population growth, decline, and long-term stabilization.

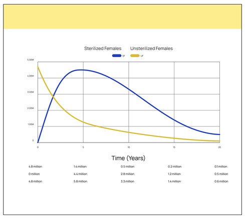
●	Variable
▨	Stock
☁	Out of consideration
⟶	Physical flows
- - - -›	Information flows

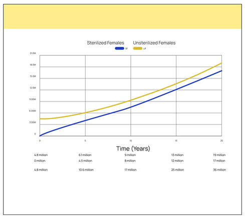

Deaths
26/100
Death rate
0
SM
Sterilized Males
Deaths

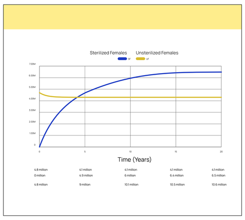
The 2 values which will be played around with is:

1. Sterilization rate F
2. Sterilization rate M

ommended sterilization targets; Reality, representing lower implementation due of sterilizing female dogs.







Opportunity *areas*

Domestic dogs evolved from wolves and gradually adapted to live alongside humans. In India, indigenous dogs evolved into the Indian Pariah or Indie dog, adapting to local environments and human settlements. Their diet also shifted from hunting towards human-associat.

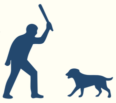
More Effort & More Impact

Create better ways for humans and stray dogs to **safely coexist** by **reducing fear**, **misconceptions**, and **conflict** during everyday interactions.

Increase **visibility** and **familiarity** of stray dogs through **media and public awareness** campaigns, encouraging **adoption** over pedigree breeds.

Track dog populations and **link population** estimates with **sterilisation, vaccination and adoption records** to understand how interventions are influencing **population change**, and use on-ground insights to continuously improve the system.

Build **public understanding** and **empathy** around stray dog **behaviour**, **vaccination**, responsible **interaction** and emergency response.



Revise outdated cruelty **penalties**, establish stronger **tracking** and **accountability** mechanisms to ensure effective **policy implementation**.

Create designated **feeding spaces** and **schedules** to make public feeding more responsible and **reduce conflict** and aggression.

Improve **waste management** so open garbage does not remain an **alternative food source** that undermines population-control efforts.

Give every dog a clear **identity** and track its **location, vaccination, sterilization** and **adoption** journey.

Less Effort & More Impact

Connect people willing to **help** with the right **organisations/groups**, such as feeding, sterilisation and adoption networks.

Recognize and **incentivize individuals and organizations** involved in stray-dog **welfare** to encourage sustained **volunteering, donations** and **participation.**

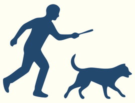
Less Effort & Less Impact

Establish a system to **register complaints**, track their **progress**, and provide **feedback** on whether and how they were **resolved**.

Private institutions, NGOs, shelters, and government bodies hold important **data**, but the lack of a **common information system** limits effective data **sharing** and **coordination.**

More Effort & Less Impact

Create systems that can **identify** emerging **shelter and care needs** earlier and enable **timely expansion** of **capacity** and **services.**



Create **safer dog-catching** practices based on dog **behaviour**, while ensuring dogs are **returned** to their **familiar** territory.

Conclusion

The system shows that stray-dog management cannot be addressed through a single intervention. Population, welfare, human–dog relationships and management practices are interconnected, so changes in one part can create effects elsewhere.

A more sustainable approach is to move from reactive, fragmented management to coordinated, preventive action using better information and tracking, responsible feeding and waste management, humane operations, population control, and stronger human - dog relationships. These efforts need to be sustained and consistent over time, as many changes take time to show results. Ultimately, this can help create safer and more sustainable coexistence for both people and dogs.

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राष्ट्रीय डिज़ाइन संस्थान
National Institute of Design
मध्यप्रदेश Madhya Pradesh

Guided by : Mr. Arun Koormamtharayil Course lead : Dr. Rakesh Vidhate

Archisha Sharma Arushi Singh Gayathri Rakesh Kimaya Wagle Naina Agrawal Ranveer Jogalekar Sajal Goud Shehruz Madambi Sreerag TK